



**University of Zabol**  
**Graduate School**  
**Faculty of Science**  
**Department of Biology**  
**The Thesis Submitted for the Degree of M.Sc**  
**( in the field of Plant Physiology)**

**Title**

**Growth and physiological responses of Wheat to Cr- Cd- Ni  
ferrite nanoparticles**

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## **Abstract**

Increasing the human population and the need for more food and the reduction of fertile soil's has led to the utilization of chemical fertilizers. Scientists attempt to increase the efficiency of low consumption nutrients and reduce the amount of fertilizers to reduce costs and environmental pollution using modern technologies.

Nanoparticles can be used to increase seed, number plant growth, plant resistance to disease and pests, and diagnosis of herbicide residues. In this study Nickel-cadmium chromium nanoparticles were synthesized using Sol-Gel Method, Melting point, and IR and NMR spectra were taken from nanoparticles.

The effect of these nanoparticles at different concentrations on germination, growth, and physiological indicators of the wheat plant, as well as phenol and flavonoid contents, were investigated. The total phenolic and total flavonoid contents were measured using the Folin Ciocalteu's and aluminum chloride colorimetry methods respectively. The wheat seeds were treated with different concentrations (100, 200, 500 ppm) of ferrite, nickel-cadmium chromium nanoparticles. In all concentrations ferrite nickel-cadmium chromium lead to an increase in the lengths of radicles root and stem as well as the total phenolic and flavonoid contents and antioxidant activity comparing to the control group. This increase was highest in 200ppm concentrations. In general, seed germination, dried weight of radicles, roots, and stems increased in low concentration of 100 and 200ppm, while a decrease in these parameters were shown in high concentration 500ppm of nanoparticles. Nickel-cadmium chromium nanoparticles can be used for wheat modification programs and as a candidate for chemical products. However, the potential negative effects of nickel-cadmium chromium delivery. ferrite nanoparticles must also be considered due to their potential transfer from plants to animals through the food chain.

**Keywords:** Nickel-cadmium chromium Ferrite Nanoparticles (Ni- Cd-Cr), Nano Fertilizer, Physicochemical Properties, Wheat